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Use of extensive winter feeding systems for backgrounding beef calves and the effect on finishing

S. McMillan,*† G. B. Penner,* J. J. McKinnon,* K. Larson,† F. Añez-Osuna,*† D. Damiran,*† and H. A. (Bart) Lardner*†[1]

*Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada, S7N 5A8; and †Western Beef Development Centre, Humboldt, SK, Canada, S0K 2A0

ABSTRACT

The introduction of low heat unit corn varieties in western Canada has led to questions on how this crop might fit into an extensive backgrounding program. Therefore, a 3-yr study was conducted to evaluate the effects of grazing standing whole-plant corn (*Zea mays* L. 'Pioneer P7443R') or swathed whole-plant barley (*Hordeum vulgare* 'Ranger') compared with barley hay fed in drylot pens on beef steer performance during backgrounding and feedlot phases. The effect of backgrounding system was also assessed during finishing when steers were fed diets based on barley grain or corn grain. Each yr, 120 Angus steers (BW = 250.5 ± 1.8 kg) were allocated to 1 of 3 replicated (n = 2) backgrounding systems: (1) field grazing swathed whole-plant barley (BSG; 11.2% CP, 60.6% TDN); (2) field grazing standing whole-plant corn (CG; 8.7% CP, 64.6% TDN); or (3) drylot (DL) bunk feeding of processed barley hay (10.9% CP, 57.2% TDN) for an average 78 d (42 to 95 d) trial. All calves received 2.5 kg/d of a range pellet supplement (16% CP, 78% TDN). Treatment groups were similar ($P > 0.05$) in final BW (295.8 ± 5.0 kg), ADG (0.59 ± 0.03 kg/d), and G:F ratio (0.187 ± 0.03 kg/kg). The cost of gain of DL, BSG, and CG steers was CAN$6.32, CAN$3.14, and CAN$2.96/kg, respectively. Following backgrounding, each replicate group of steers was subdivided and placed in a feedlot for finishing on either a barley- (12.2% CP, 75.4% TDN) or corn grain–based (11.3% CP, 74.7% TDN) diet for an average of 120 d. There were no backgrounding system, finishing, or backgrounding system × finishing interaction effects ($P > 0.05$) for feedlot DMI, ADG, G:F, or carcass characteristics. Study results suggest that grazing either swathed barley or whole-plant corn for 65 d during backgrounding can reduce ($P = 0.05$) costs by CAN$60 and CAN$70/steer, respectively, compared with feeding steers barley hay in a drylot.

Key words: backgrounding, barley, corn, feedlot finishing, swath grazing

INTRODUCTION

Backgrounding is the controlled rate of growth of beef animals to adjust frame size before the deposition of fat to obtain inexpensive weight gain and greater carcass weight at slaughter (Kumar et al., 2012). Muscle development and skeletal size are related to carcass weight and potential growth during the finishing phase (Tatum et al., 1988). In western Canada, beef calves are typically weaned around 200 to 250 kg of BW and are then backgrounded in drylot for 100 to 150 d during winter until they reach 350 kg (Karantininis et al., 1997; Sheppard et al., 2015). Alternative backgrounding systems using extensive winter grazing systems have lower costs (Kumar et al., 2012), but the type of forage used must meet energy and protein requirements without constraining DMI (NASEM, 2016). Forage quality is important because a 250-kg weaned steer targeted to gain 0.8 kg/d requires 9.8% CP and 60% TDN (NASEM, 2016). Cool-season annual forages such as barley (*Hordeum vulgare* L.; 11.9% CP, 60% TDN; NASEM, 2016) are well suited to Northern Great Plains growing conditions and provide acceptable forage yield and quality and animal performance (McCartney et al., 2008). Past research evaluating extensive grazing has shown that calves grazing swathed whole-plant barley in field paddocks had 49% lower total cost of production for backgrounding than calves fed in drylot pens (Kumar et al., 2012).

Corn (*Zea mays* L.) is a warm-season annual forage that is grown in western Canada for grain and silage production (Lardner, 2004). With the introduction of low heat unit hybrids, there is a relatively new opportunity to use whole-plant corn in extensive grazing systems with beef cows (Lardner et al., 2012). The low heat unit hybrids can produce yields ranging between 9.4 and 12.0 t/ha (DM basis) in regions where corn growth was previously not feasible (Lardner et al., 2017). The nutrient content (9% CP, 70% TDN; Lardner et al., 2017) of the whole-plant corn should meet the dietary requirements for backgrounding calves, suggesting that these hybrids could serve as the forage source for backgrounding programs. However, stud-

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[1]Corresponding author: bart.lardner@usask.ca

ies evaluating the effect of extensive winter feeding systems on backgrounding steer performance in relation to traditional drylot feeding systems and subsequent feedlot performance are limited (Kumar et al., 2012). Therefore, the study objectives were to compare grazing swathed whole-plant barley or standing whole-plant corn to a traditional drylot system for differences in forage yield and quality, steer performance, system cost, and subsequent feedlot performance of steers consuming either barley- or corn-based finishing diets.

MATERIALS AND METHODS

Backgrounding Trial

Experimental Sites and Crop Management. A 3-yr beef steer backgrounding study was conducted at the Western Beef Development Centre's Termuende Research Ranch near Lanigan (51°51N, 105°02W), SK, Canada. The study site is located in the Black soil zone of Saskatchewan, and the soil is classified as Chernozemic Black Oxbow soil (Saskatchewan Soil Survey, 1992). In the spring of each year (June 7, 2012; May 23, 2013; June 11, 2014), a 3.2-ha field was seeded to corn [*Zea mays* L. 'Pioneer P7443R' (Pioneer Hi-Bred International Inc., Johnston, IA)] using a John Deere 7000 planter (Moline, IL) at the rate of 73,000 seeds/ha with a 76-cm row spacing, and 134 kg/ha of actual nitrogen (N, urea) fertilizer was applied before planting and incorporated. Also, in the spring of each year (June 8, 2012; June 6, 2013; June 13, 2014), a 4.0-ha field was seeded to barley (*Hordeum vulgare* 'AC Ranger'; 109 kg/ha seeding rate) using a Seed Hawk 51–9 air drill (Seed Hawk Inc., Langbank, SK, Canada) along with 56 kg/ha of N fertilizer. Preseeding soil test results indicated that P, K, and S were adequate for production of both crops, and no other fertilizer was applied. Weed control in the corn crop was managed with pre- and postseeding applications of 0.40 L/ha of glyphosate [N-(phosphoromethyl) glycine; Roundup; Monsanto, Creve Coeur, MO] each year (June 1, June 23, and July 5, 2012; June 1, June 26, and July 5, 2013; May 31, July 4, and July 15, 2014). The barley crop received an application (1.2 L/ha) of Refine SG (thifensulfuron methyl 33.35% and tribenuron methyl 16.65%) and Axial Bia (pinoxaden) herbicide (Syngenta Canada Inc., Guelph, Ontario, Canada) each year (July 5 and 22, 2012; June 26 and July 20, 2013; July 4 and 24, 2014). Each year, 2 ha of whole-plant barley was swathed in mid to late August (August 15, 2012; August 25, 2013; August 27, 2014) at soft dough stage into windrows for winter grazing (**BSG**), and the remaining 2 ha was swathed, field wilted, and baled (DM >88%) as round bales (598 ± 48 kg) using a New Holland BR780 round baler (New Holland Inc., New Holland, PA) and fed as processed barley hay in bunks in drylot pens (**DL**). The corn crop was left standing for grazing (**CG**). Subsequently, the swathed barley and corn fields were divided into 2 paddocks (1 and 1.6 ha for barley and corn, respectively) to make 2 replicates (n = 2) for each grazing trial using portable electric fence. The same field site was used for each crop in all 3 yr to avoid confounding residual effects in yr 2 and 3.

Backgrounding Systems and Animal Management. Over the 3 yr study, the backgrounding phase ran from December 12, 2012, to February 19, 2013 (yr 1, 68 d); October 17, 2013, to February 21, 2014 (yr 2, 95 d); and November 18 to December 30, 2014 (yr 3, 42 d). Each year, 120 spring-born, fall-weaned Black Angus steers (average BW = 251, 250, and 250 kg for yr 1, yr 2, and yr 3, respectively) were stratified by BW and randomly allocated to 1 of 3 replicated (n = 2) backgrounding systems: (1) grazing standing whole-plant corn (CG) in field paddocks; (2) grazing swathed whole-plant barley (BSG) in field paddocks; or (3) feeding processed whole crop barley hay (DL) in a drylot pen. Calves were cared for in accordance with the Canadian Council on Animal Care (2009) guidelines. All calves were implanted with 36 mg of zeranol (RALGRO; Schering-Plough Corp., Kenilworth, NJ) and vaccinated against bovine respiratory syncytial virus [*Mannheimia* (*Pasteurella*) *haemolytica*], infectious bovine rhinotracheitis (bovine herpes virus-1), bovine viral diarrhea (bovine viral diarrhea virus), and parainfluenza 3 (bovine parainfluenza virus-3) with Express 5 (a modified live bovine viral diarrhea, infectious bovine rhinotracheitis, parainfluenza 3 vaccine; Boehringer Ingelheim, Burlington, ON, Canada), Somnu-Star PH (a modified live *Haemophilus somnus* vaccine; Novartis Animal Health, Mississauga, ON, Canada), and Tas-Vax 8 (a modified live *Clostridium* Type B, *perfringens* Types B, C, and D, bacterin-toxoid vaccine; Merck Animal Health, Madison, NJ) at the start of the trial. A ration-balancing program (CowBytes Version 5, Alberta Agriculture, Food and Rural Development, Alberta, Canada) was used to determine feed allocation based on BW, forage nutrient analysis, and environmental conditions. The amount of feed (forage + supplementation) allocated was intended for an ADG of 0.6 kg/d.

Field paddocks used for grazing were perimeter fenced with high-tensile wire electric fencing, and forage was allocated every 3 d by using portable electric fence to meet the targeted ADG, maximize utilization, and minimize wastage (Volesky et al., 2002; Kumar et al., 2012). For the DL system, barley hay was processed using a 6600 Highline bale processor (Highline Manufacturing Ltd., Vonda, SK, Canada) through a 9.5-cm screen and fed ad libitum once daily at 0800 h with a scale-equipped Farm Aid 430 mixer wagon (Corsica, SD) as a TMR, with the amount of feed delivered to each pen recorded. Every 2 wk, the bunks were cleaned and any orts were weighed. Actual DMI was calculated based on DM delivered to the pen and corrected for orts.

Additionally, all calves were supplemented daily at 0800 h with 2.5 kg/d of a range pellet [16% CP, 78% TDN; 100 mg/kg monensin sodium (Rumensin 200; Elanco Animal Health, Guelph, ON, Canada)] to meet nutrient (energy,